Using EcoFlight, an innovative aerial survey method, to monitor mountain pine beetle outbreaks in whitebark pine of the Greater Yellowstone Ecosystem

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The Issue

With the advent of anthropogenic climate change an increasing number of widespread and on-going MPB outbreaks have occurred in the WBP forests of the GYE.

A number of these outbreaks have been documented by ADS and plot surveys.

However, due to the limited size and inherent limitations of ADS and on-the-ground plot surveys the full extent of the outbreaks is unknown.

Limitation of ADS for WBP

- ADS does not typically survey designated Wilderness or National Parks-- almost 2/3 of GYE WBP is in either Wilderness or Parks (shown on following slide)

- ADS prioritizes economically important timber species like lodgepole pine as a result, the conditions of WBP forests have largely gone unmonitored

- We believe, with its current limited aerial coverage and lack of focus on WBP, the ADS method is an inadequate monitoring tool for WBP forests


Greater Yellowstone Ecosystem
A comparison of whitebark pine distribution
wilderness area and national park vs
non-wilderness non-national park
Legend
N

The EcoFlight Approach

Designed specifically to address the inadequacy of the ADS

- Focuses exclusively on WBP/MPB damage
- The bright red foliage the summer following successful attacks is clearly visible from aircraft and does not require extensive training to recognize
- By using a landscape category rating, a total cumulative impact is assisted as opposed to ADS which provides current year mortality only

The EcoFlight Approach

How it works

- EcoFlight uses low-flying airplane overflights, GPS, digital photography and GIS technologies

- Each georeferenced photo is attributed with a landscape category (0-5) (see following slide)

- Over the course of an EcoFlight the condition of the entire area is documented with the acquisition of hundreds of digital photos attributed with appropriate landscape categories

O (Zero) -No unusual MPB activity on the landscape

1 (One)- Occasional spots of killed trees on the landscape

2 (Two) -Multiple spots of killed trees on the landscape that show two or more years of subsequent mortality

EcoFlight Whitebark Pine Classification Categories

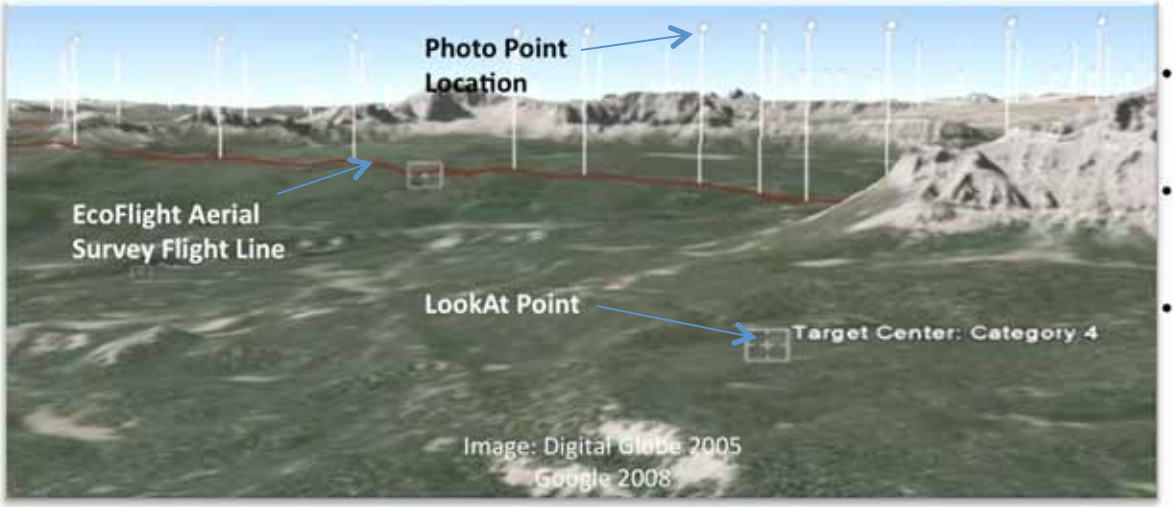
3 (Three) -Multiple spots that have coalesced

4 (Four) -The "Sea of Red"
Essentially the entire WBP overstory is dead

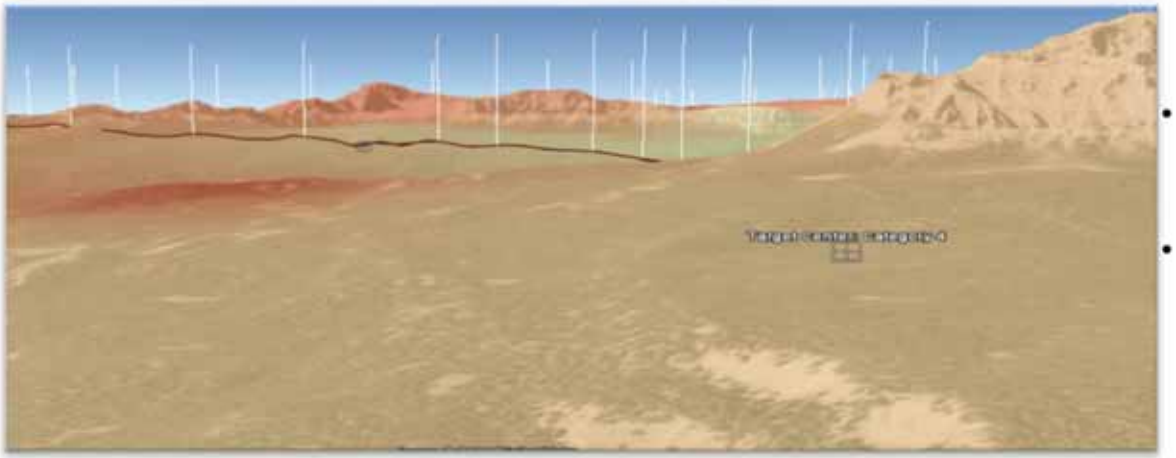
5 (Five) –The "bathtub ring of the Rockies"
The residual forest remaining after an outbreak

The EcoFlight Approach

- **Digital photos** are taken from the plane at specific spots along flightlines



- **PhotoPoint locations** are generated with onboard GPS units
- Then the "**LookAt points**" are calculated with a GIS
- Each "**LookAt point**" is assigned the appropriate outbreak category of respective photo



- **Surface Generation:** "LookAt points" are used to interpolate a surface representing outbreak category values
- **Map Generation:** The final interpolated surface provides a "continuous" WBP classification map for the area surveyed

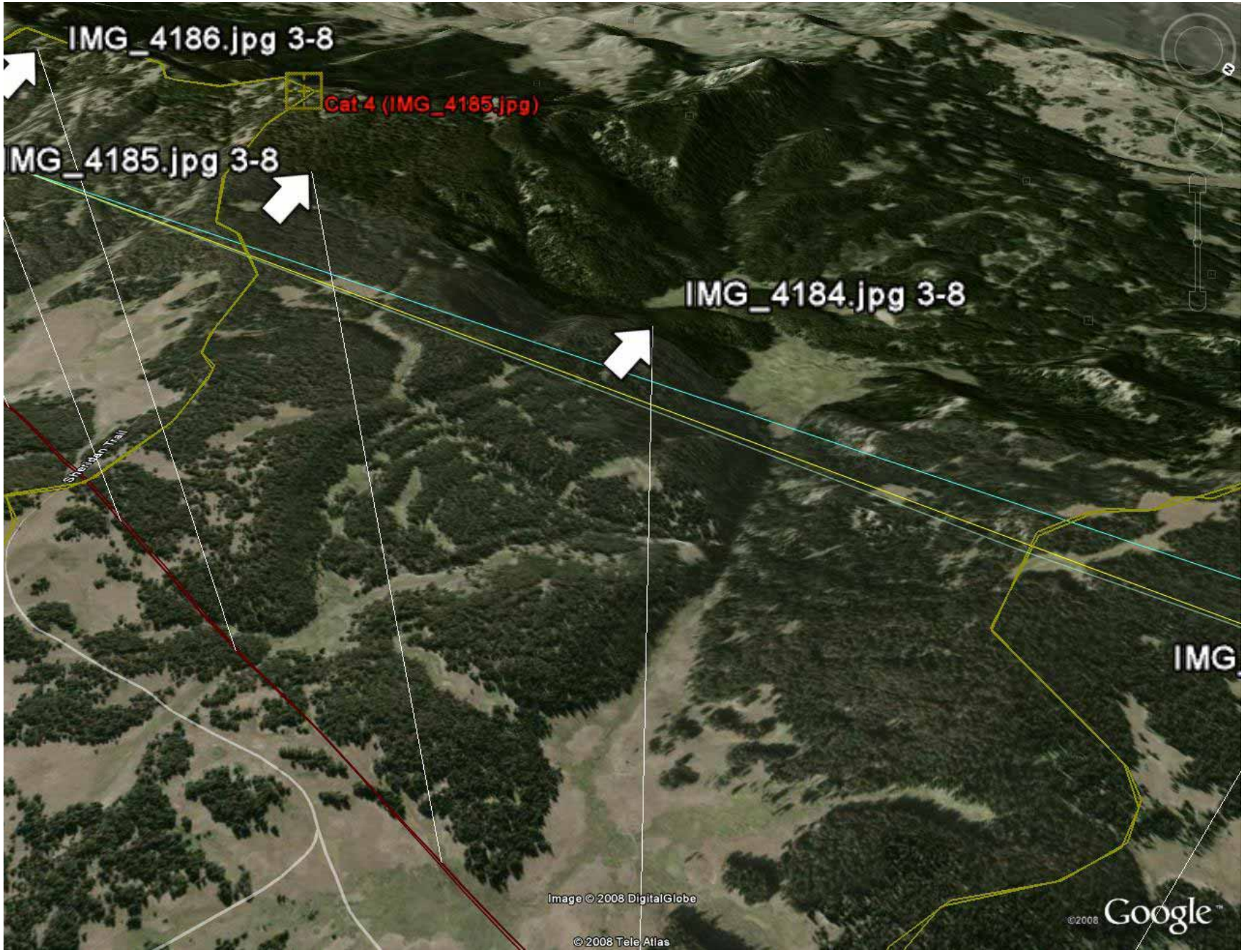

IMG_4186.jpg 3-8
Cat 4 (IMG_4185.jpg)
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Image © 2008 DigitalGlobe
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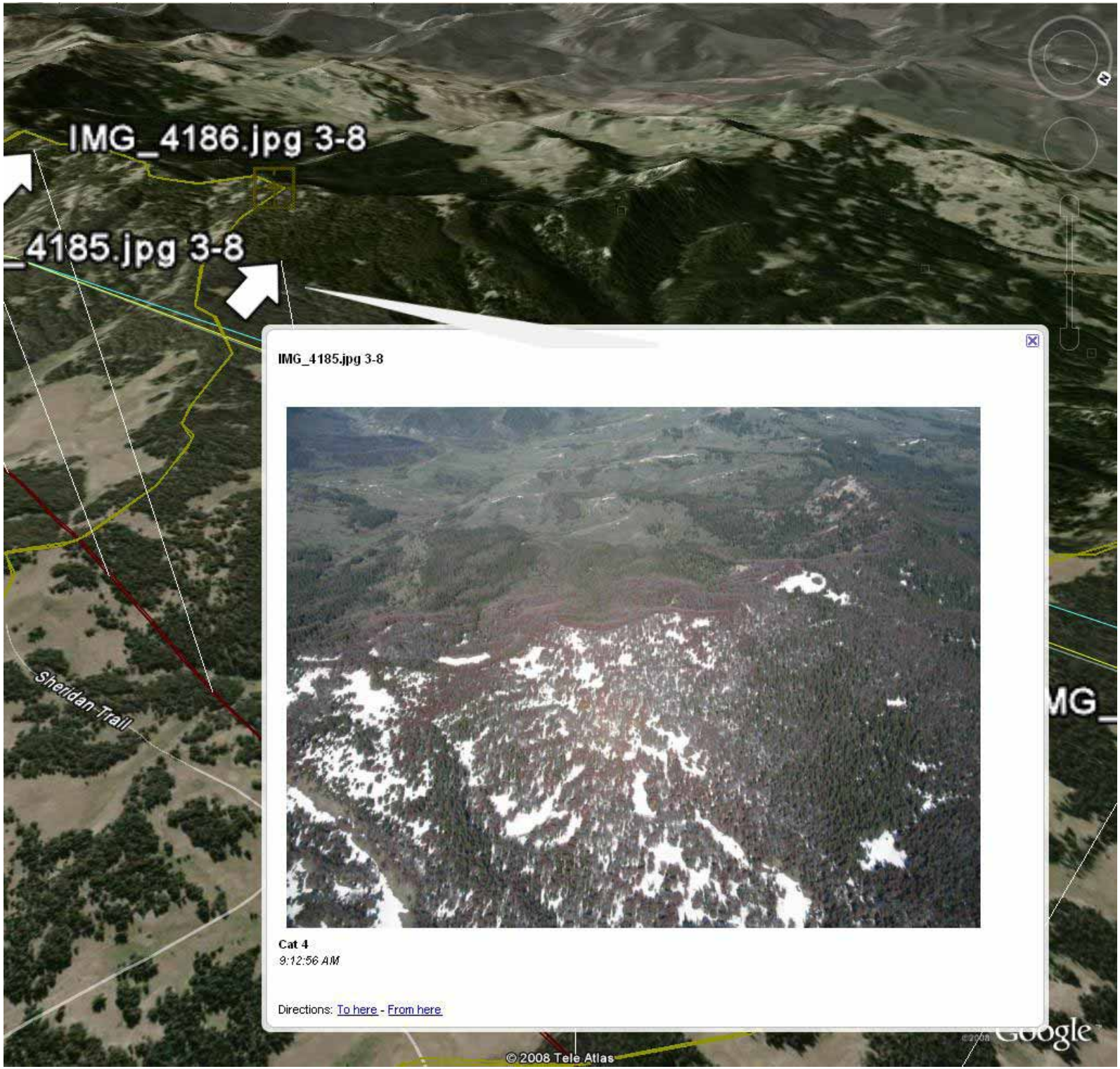
IMG_4186.jpg 3-8
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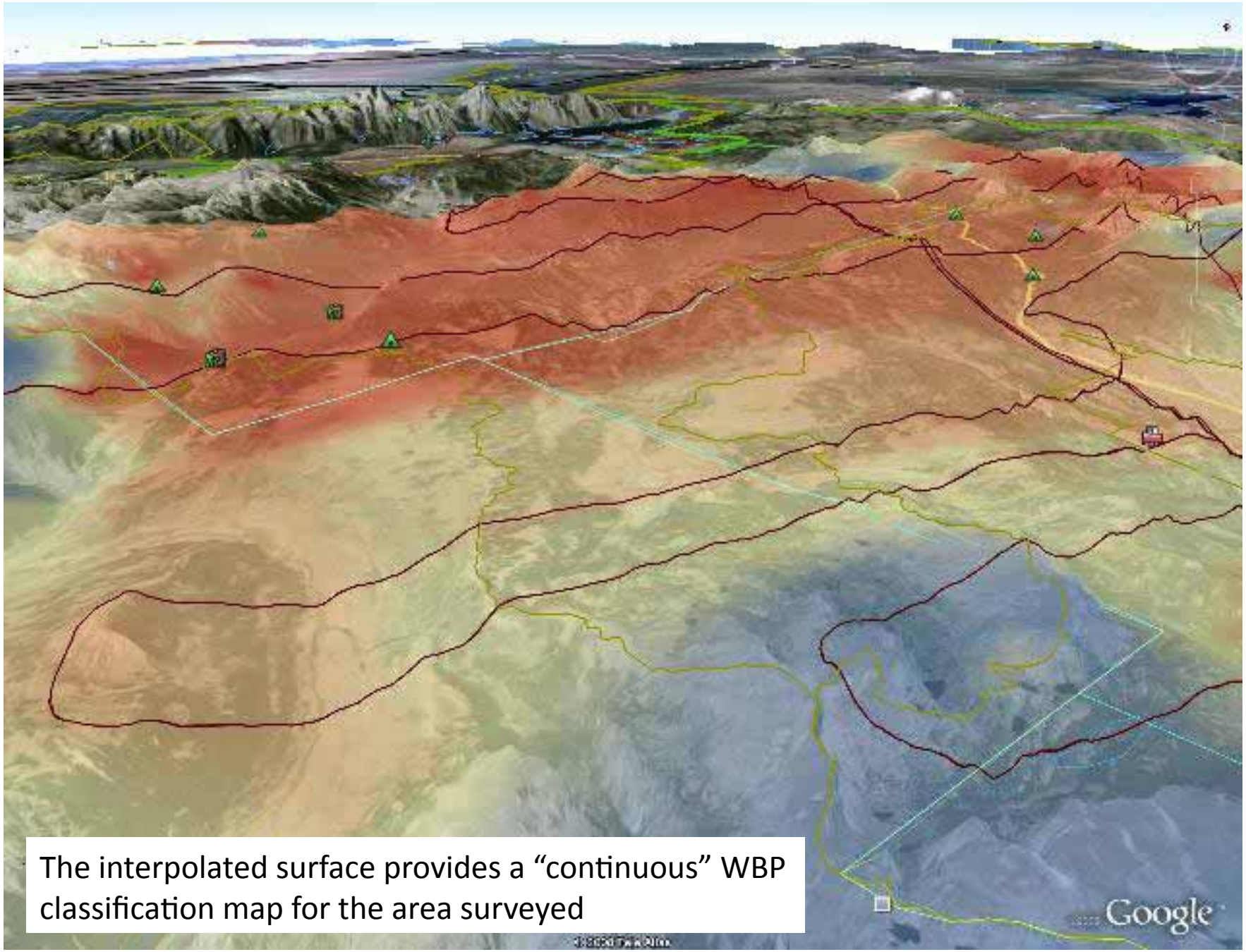
Sheridan Trail
IMG_4185.jpg 3-8
Cat 4
9:12:56 AM
Directions: To here - From here
© 2008 Tele Atlas
Google



The interpolated surface provides a “continuous” WBP classification map for the area surveyed

EcoFlight Pilot Study

Summer 2008

- EcoFlight was *tested* in five areas (shown on the following slide)

- Including portions of the Absaroka, Beartooth, Gallatin, Gros Ventre, Wind River and Washburn Mountain Ranges

- Areas were selected based on computer simulations of potential outbreaks, ADS data results and in-field reconnaissance

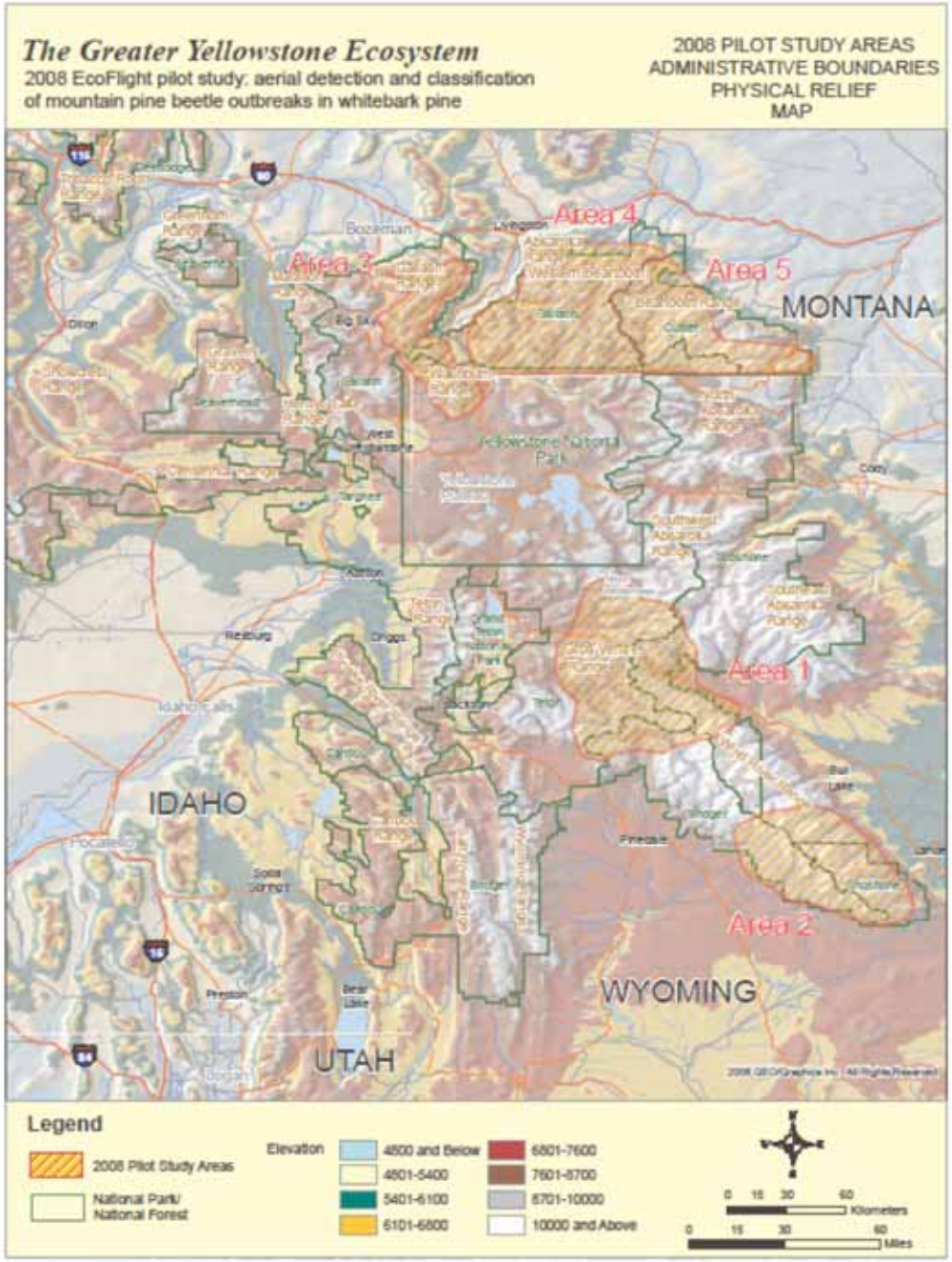


Figure 5. 2008 EcoFlight pilot study area map

2008 Pilot Study Results

- WBP forests throughout the GYE are experiencing high-intensity MPB outbreaks
- In many areas essentially the entire WBP overstory is dead because of these outbreaks
- Of the areas surveyed only the center core of the Wind River Range, the Beartooth Plateau and portions of Northern Gallatin Range remain in a healthy condition

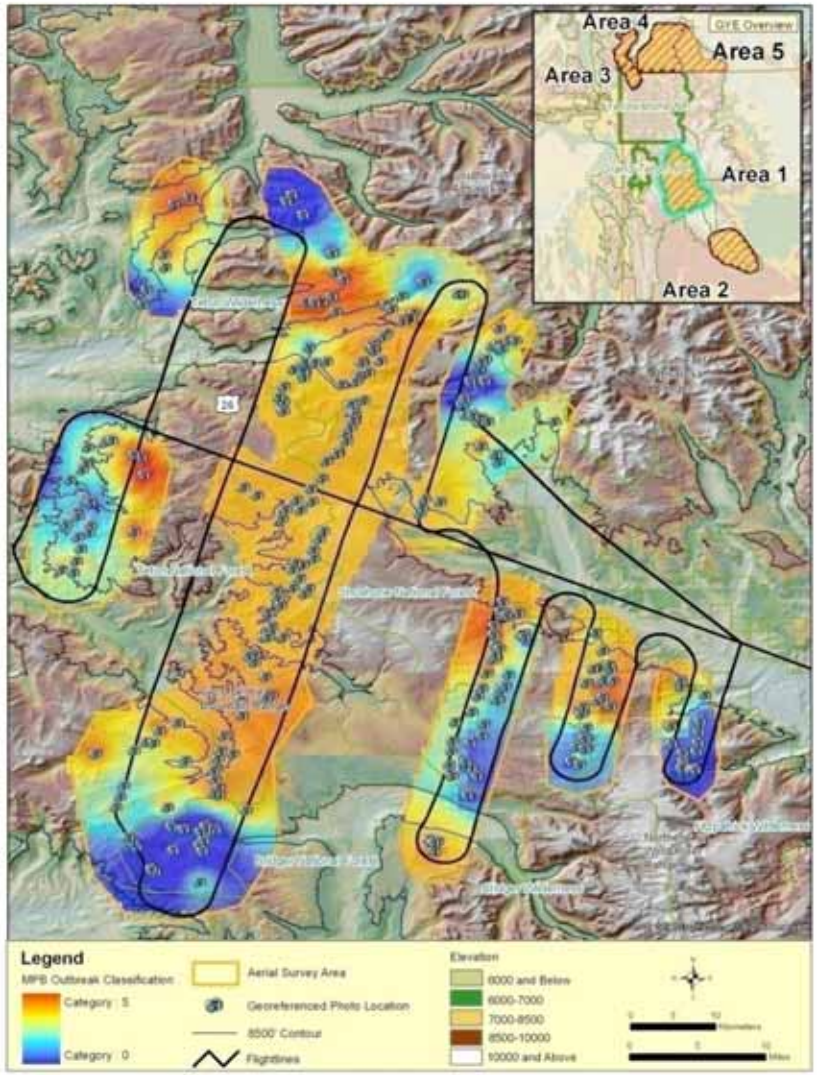


Figure 6. Map showing the spatial extent and severity of WBP mortality related to MPB outbreaks in Study Area 1: Northern Wind River Range, Gros Ventre Wilderness and Teton Wilderness.

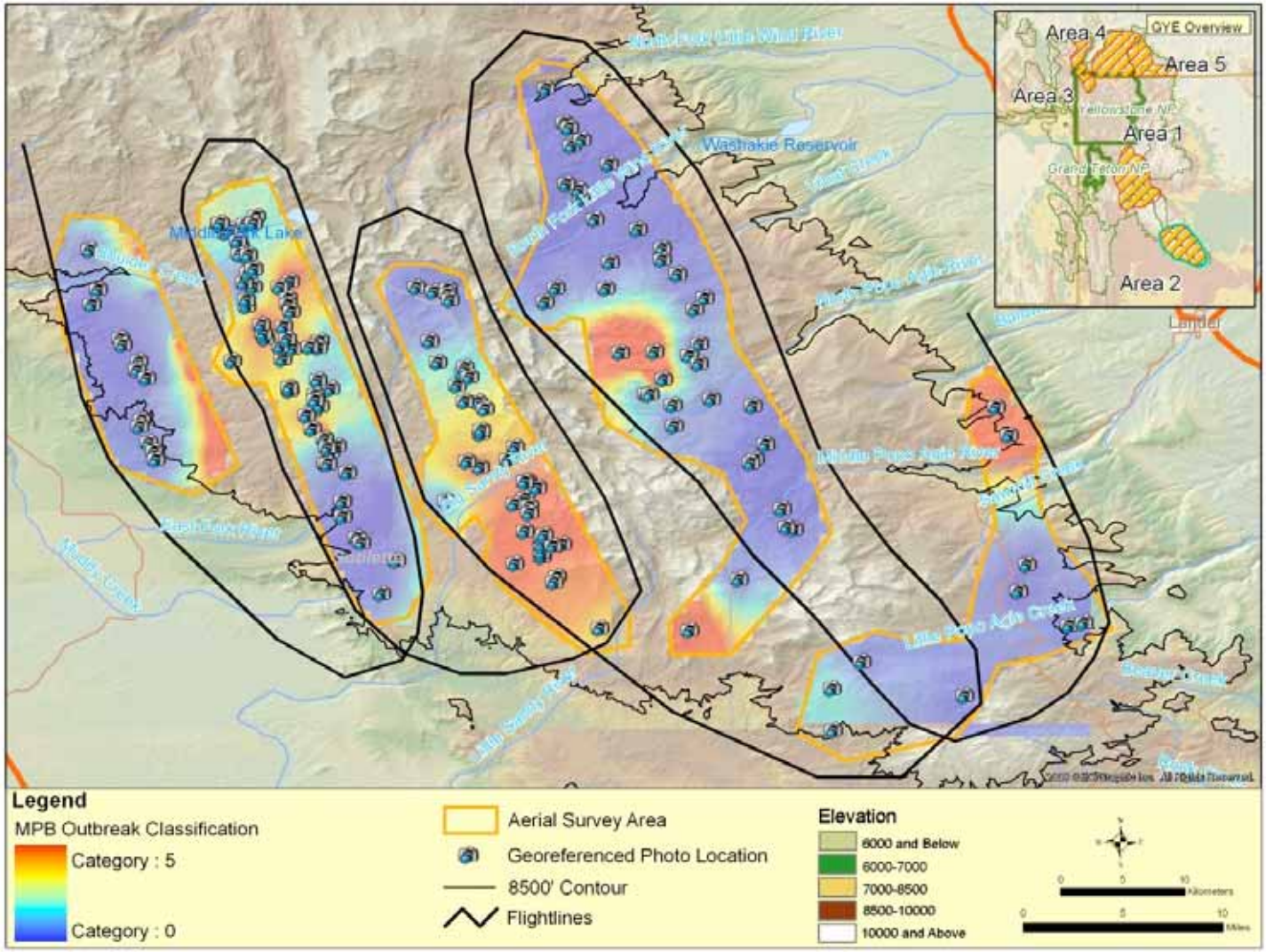


Figure 9. Map showing the spatial extent and severity of WBP mortality related to MPB outbreaks in Study Area 2: Southern Wind River Range.

Category 4:
"Sea of Red" (potential restoration site?)

Teton Wilderness, 2008

Category 0:
No unusual MBP Activity (potential preservation site?)

Beartooth Plateau, 2008

Conclusions

EcoFlight Pilot Study

- EcoFlight effectively documented an ecological collapse of the WBP ecosystem in several areas throughout the GYE

- The pilot study provided an independent validation of ADS data
  - even though the two approaches are very different EcoFlight corroborates the general trend indicated by ADS data – WPB is in trouble!
  - When combined ADS data and EcoFlight data creates a rich, complementary dataset.

- Our pilot study indicates that the EcoFlight is a reliable, cost-effective and repeatable monitoring method which can provide useful information for the conservation of the species by identifying areas that suitable for restoration (hardest hit forests) and preservation (intact healthy forests).

- As a result the *Forest Service Western Bark Beetle Project* and the *Greater Yellowstone Whitebark Pine Committee* have dedicated funds to use the EcoFlight in the summer of 2009 to document the entire GYE

Acknowledgements

- Generous funding from the *Natural Resources Defense Council (NRDC)* and aerial surveys by *EcoFlight* made the pilot project a reality
- I would like to thank *the staff at GEO/Graphics and members of NRDC WBP Citizen Science Program and the Greater Yellowstone Whitebark Pine Committee* for their commitment to this important research.

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